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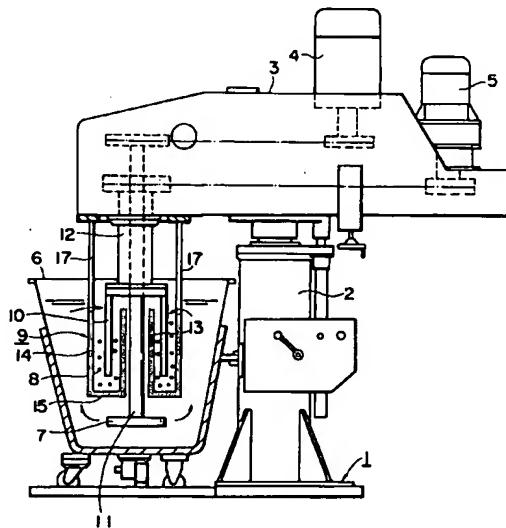
(54) Dispersing and grinding apparatus.

(57) A dispersing and grinding apparatus which comprises a tank (6), a basket (9) disposed within the tank (6), containing a dispersing medium (8) and a stirring blade (7) disposed under the basket, wherein a material to be processed is made to flow within the tank, and the material to be processed entered in the basket (9) is dispersed by means of the dispersing medium (8).

The basket (9) is formed into an annular groove shape constituted with a cylindrical inner wall (13) surrounding a stirring shaft (11), an outer wall (14) surrounding the inner wall (13) and a bottom wall (15) extending at the bottom portion of the inner wall and the outer wall. The dispersing medium is contained in the annular groove constituted with the inner wall and the outer wall. The stirring shaft (11) having a material-stirring blade (7) for stirring the material to be processed, extends through a cylindrical space formed at the center of the basket, and rotates under a free condition. Thus, the material-stirring shaft does not adversely affect the basket. The medium-stirring blade (10) for moving the dispersing medium (8) within the annular groove is disposed to the material-stirring shaft (11) or the medium-stirring shaft having the same core as the material-stirring shaft.

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FIG. 1



BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to a dispersing and grinding apparatus for dispersing material to be processed by means of dispersing medium such as balls, beads, etc., and more particularly to a dispersing and grinding apparatus of a batch system.

(2) Background of the Invention

Generally, in a conventional dispersing and grinding apparatus, a mixture of the dispersing medium and the material to be processed is stirred, and the material is finely ground by shearing force generated between the media to disperse the material in liquid. As such an apparatus, there have been known dispersing and grinding apparatuses wherein the above dispersion process is carried out by a continuous system or a batch system.

As the dispersing and grinding apparatus carrying out the dispersion process by the batch system, there have been known dispersing and grinding apparatuses comprising a tank and a basket, disposed within the tank, containing the dispersing medium (for example, Japanese Examined Patent Publication No. 46665/1984 and Japanese Unexamined Patent Publication No. 210020/1989). Such an apparatus is provided with a flowing blade under the basket, whereby the material to be processed in the tank is stirred and circulated within the tank such that the material to be processed is made to flow in the basket. The material to be processed, flowing in the basket is stirred and dispersed together with the dispersing medium by a medium-stirring blade.

In such an apparatus, a stirring shaft connected with a motor is supported by a bearing section disposed at the lower part of the basket, and extends toward the lower portion. The flowing blade and the medium-stirring blade each are disposed around the stirring shaft.

In the conventional dispersing and grinding apparatus of the batch system, the stirring shaft is inserted through the bearing section disposed at the lower part of the basket. Therefore, upon a long-term use, it has sometimes happened that the dispersing medium is made to enter a through-hole section of the stirring shaft thereby abrading the through-hole section. Further, with the progress of the abrasion, it has happened that the rotation is obstructed or the dispersing medium flows out of the basket into the tank and is incorporated in the material to be processed. In addition, since the flowing blade and the medium-stirring blade rotate

around the same shaft, it has been difficult to control adequately depending on the material to be processed.

A dispersing and grinding apparatus is known wherein the stirring shaft is disposed outside the basket and the flowing blade is disposed at the end of the shaft to circulate the material to be processed within the tank. In such a dispersing and grinding apparatus, since the flowing blade is positioned one-sidedly within the tank, the material to be processed flowing within the tank tends to flow eccentrically, and thus hardly flows in the basket uniformly. Hence, the dispersion efficiency of such an apparatus is poor as compared with the dispersing and grinding apparatus wherein the flowing blade is disposed at the center of the tank.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a dispersing and grinding apparatus having excellent dispersion efficiency, in which the rotation of the stirring shaft is not interfered and the dispersing medium does not flow out of the basket in the tank.

Another object of the present invention is to provide a dispersing and grinding apparatus as mentioned above, wherein the rotation of the material-stirring blade by which the material to be processed is made to flow and the rotation of the medium-stirring blade by which the dispersing-medium is stirred are individually controlled.

The above objects can be accomplished by the present invention which provides a dispersing and grinding apparatus comprising a basket formed into an annular groove shape, having an inner wall formed into a cylindrical shape surrounding a material-stirring shaft which actuates stirring blade for a material to be processed, an outer cylindrical wall surrounding an outer circumference of the inner wall, and a bottom wall extending at the bottom portion of the inner wall and the outer wall, wherein the annular groove of the basket contains a dispersing medium and the material-stirring shaft is extended freely through an annular space formed at the center of the basket to disperse the material to be processed.

Other objects and features of the present invention will become apparent to those skilled in the art upon reading the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of one embodiment of a dispersing and grinding apparatus of the present invention with a portion of a tank shown in cross section.

Fig. 2 is a perspective view of a basket of a dispersing and grinding apparatus of the present invention.

Fig. 3 is a cross-sectional view of a tank portion of another embodiment of a dispersing and grinding apparatus of the present invention.

Fig. 4 is a cross-sectional view of a tank portion of a further embodiment of a dispersing and grinding apparatus of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In Fig. 1, a body 1 has a stirring head 3 which can be moved up and down by a hydraulic cylinder 2. The stirring head 3 is provided with motors 4 and 5 for actuating stirring shafts as mentioned below.

A tank 6 containing the material to be processed is positioned under the stirring head 3. The stirring head 3 is provided with a material-stirring blade 7, inserted into the tank 6, for stirring the material to be processed in the tank, a basket 9 for containing a dispersing medium 8, and a medium-stirring blade 10 for stirring the dispersing medium in the basket which are hanging from the head.

A material-stirring shaft 11 for actuating the material-stirring blade 7 is rotated by the motor 4 by means of an appropriate transferring means such as a belt, a pulley or the like.

In Fig. 1, the medium-stirring blade 10 is mounted on a medium-stirring shaft 12 having the same core as the material-stirring shaft 11, and is rotated by the motor 5 by means of an appropriate transferring means such as a belt, a pulley or the like at a lower speed than the material-stirring blade 7.

The basket 9 having an annular shape groove 16 formed for containing the dispersing medium 8 (in Fig. 2), comprises an inner wall 13 formed into a cylindrical shape which surrounds the material-stirring shaft 11 under such a condition that the shaft can be rotated freely, a cylindrical outer wall 14 which surrounds the outer circumference of the inner wall 13, and a bottom wall 15 extending at the bottom portion of the inner wall 13 and the outer wall 14. The inner diameter of the inner wall 13 may be of such an extent that it slightly contacts with the stirring shaft 11 so long as the stirring shaft 11 can be rotated freely, but preferably such an extent that they are in the non-contact condition.

At least one part of the inner wall 13, outer wall 14 and the bottom wall 15, or the entire wall of respective walls in the drawings, is comprised of a screen which may prevent the passage of the dispersing medium. The screen can be made of a metal net material, a perforated metal sheet, etc.

Further, the basket is entirely formed into a cylindrical shape, but may be formed into an inverse cone shape, a square cylindrical shape, a shape having a polygonal cross-section, etc. The above bottom wall 15 is formed integrally with the inner wall 13 and the outer wall 14, but may be formed such that a lid separately formed is disposed at a part of the bottom wall 15. The lid may be mounted so that it can be opened and closed. Alternatively, the bottom wall may be constituted to have a curved shape in series with the inner wall 13 and the outer wall 14.

In Fig. 1, the basket 9 is fixed to the stirring head 3 with hanging members 17 disposed around it as shown in Fig. 2. However, the basket may be disposed rotatably as mentioned below.

The medium-stirring blade 10 is formed into a paddle shape so that it can be rotated freely within the annular groove 16, and the blade may be comprised of one piece, but preferably of two or more pieces or plural pieces as shown in the drawings.

Since the dispersing and grinding apparatus as shown in Fig. 1 is constituted as mentioned above, the material-stirring shaft 11 extends through a cylindrical space 13a formed at the center of the basket 9, and can be rotated freely irrespective of the basket. By rotating the material-stirring blade 7 at a high speed, the material to be processed flows uniformly from the lower portion toward the upper portion within the tank 6 and flows in the basket 9. The material to be processed, entered the basket 9, is finely ground and dispersed in a liquid by the dispersing medium 8 which is stirred at a low speed by the medium-stirring blade 10 within the basket 9, and then flows in the tank again from the basket 9. Such a flow-in and flow-out are repeated and the material to be processed is thoroughly dispersed. In this example, the rotations of the material-stirring blade 7 and the medium-stirring blade 10 are separately adjusted and thus the dispersion process can be conducted at optimum conditions depending on the material to be processed.

Fig. 3 shows another example of the present invention. In this example, a medium-stirring blade 18 is disposed to a material-stirring shaft 19 and rotates together with a material-stirring blade 20. The other constitution is substantially the same as the example as illustrated in Fig. 1. The basket 9 is fixed to the stirring head. Such an apparatus has a simple structure and thus is preferably used for material to be processed having a low viscosity and the like.

Fig. 4 shows a still another example of the present invention. In this example, a medium-stirring blade 21 is disposed to a material-stirring shaft 22 and rotates together with a material-stirring

blade 23, and such a construction is the same as the example as shown in Fig. 3. However, a basket 24 is disposed to a rotating shaft 25 having the same core as the material-stirring shaft 22, and is rotated. The constitution of the basket 24 itself is the same as the above-mentioned example, and thus is identified with the same numerals. Further, a scratching blade 26 is disposed to the rotating shaft 25 so as to rotate along the inner wall of the tank 6.

When the material-stirring shaft 22 is rotated at a high speed and the rotating shaft 25 is rotated at a lower speed than the material-stirring shaft 22 toward the reverse direction, the basket 24 is rotated toward the reverse direction against the flow of the material to be processed and thus the shearing force by the dispersing medium 8 is frequently applied to the material to be processed within the basket to conduct the process uniformly and fast. Further, since the opening area of the screen is relatively increased, the amounts of the material to be processed flowing in and flowing out of the basket are increased and thus the dispersing time can be shortened.

In addition the material to be processed having a high viscosity can also be made to flow securely within the tank by the scratching blade 26. The material is drawn toward the material-stirring blade 23 rotating at a high speed and made to flow in the basket 24, and then dispersed.

In the present invention constituted as mentioned above, the material-rotating shaft can be rotated freely irrespective of the basket containing the dispersing medium, thereby solving the problems that the dispersing medium flows out and the rotation of the stirring shaft is interfered. Further, when the medium-stirring blade and the material-stirring blade are separately rotated, various materials to be processed having different viscosities, can be processed.

2. The dispersing and grinding apparatus according to claim 1, wherein the basket (9), (24) is formed into an annular groove shape constituted with an inner wall (13) formed into a cylindrical shape having an internal diameter which permits to surround a material-stirring shaft, an outer wall (14) surrounding the outer circumference of said inner wall, and a bottom wall (15) extending at the bottom portion of the inner wall and the outer wall, and a screen which prevents the passage of the dispersing medium is formed on at least one part of the inner wall, the outer wall and the bottom wall.
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2. The dispersing and grinding apparatus according to claim 1, wherein the basket (9), (24) is formed into an annular groove shape constituted with an inner wall (13) formed into a cylindrical shape having an internal diameter which permits to surround a material-stirring shaft, an outer wall (14) surrounding the outer circumference of said inner wall, and a bottom wall (15) extending at the bottom portion of the inner wall and the outer wall, and a screen which prevents the passage of the dispersing medium is formed on at least one part of the inner wall, the outer wall and the bottom wall.
3. The dispersing and grinding apparatus according to claim 1, wherein the medium-stirring blade (10) is disposed to a medium-stirring shaft (11) having the same core as the material-stirring shaft 22 and rotates at a lower speed than the material-stirring blade (7).
4. The dispersing and grinding apparatus according to claim 1, wherein the medium-stirring blade (18) is disposed to the material-stirring shaft (19).
5. The dispersing and grinding apparatus according to claim 4, wherein the basket (24) is rotated by a rotating shaft (25) which has the same core as the material-stirring shaft (22).
6. The dispersing and grinding apparatus according to claim 5, wherein the rotating shaft (25) is provided with a scratching blade (26) which rotates at a low speed along the inner wall of the tank (6).

Claims

1. A dispersing and grinding apparatus comprising a tank for containing a material to be processed, a material-stirring blade for stirring the material to be processed within the tank, a basket for containing a dispersing medium, and a medium-stirring blade for stirring the dispersing medium within said basket, characterised in that the basket has a cylindrical space (13a) formed at the center of the basket (9), (24), and is formed into an annular groove shape surrounding a circumference of the material-stirring shaft (11), (19), (22) actuating the material-stirring blade (7), (20), (23), and the material-stirring shaft is extended freely through said space (13a).

FIG. 1

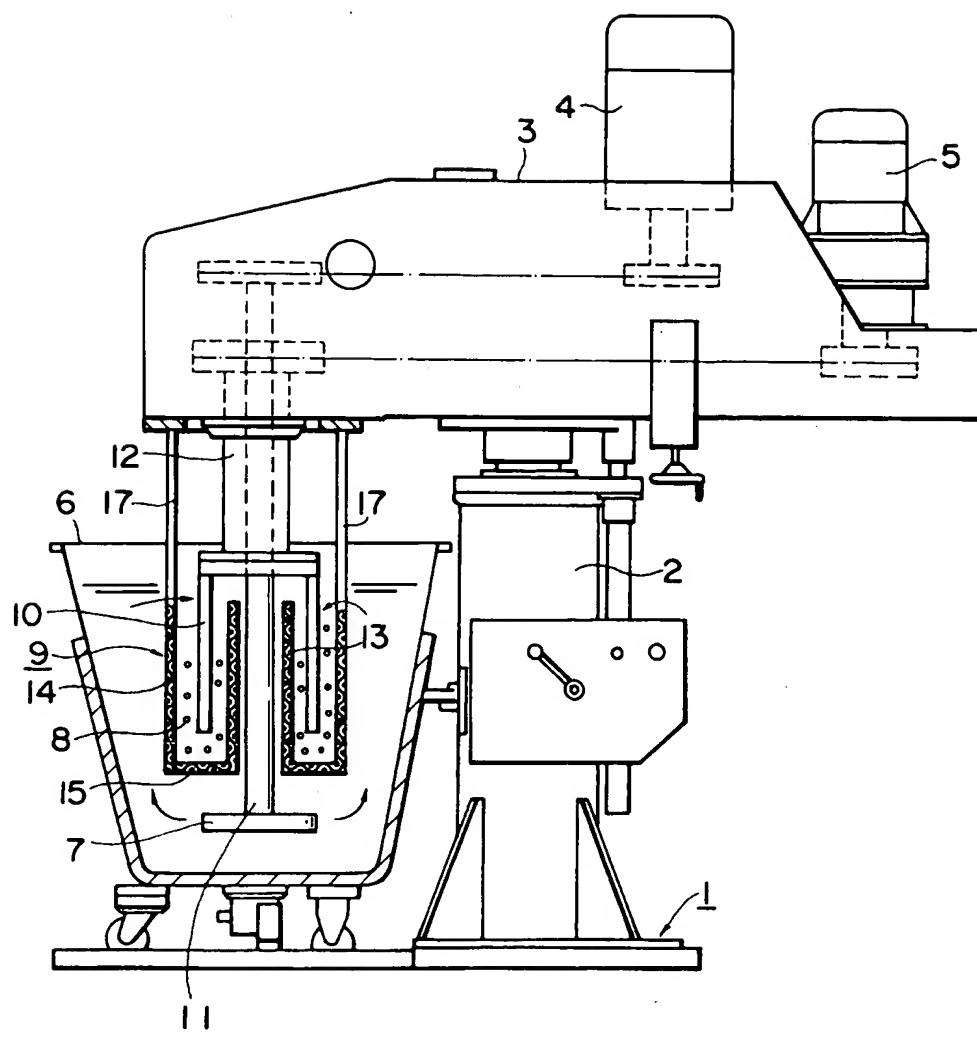


FIG. 2

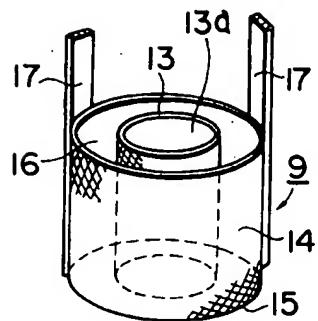


FIG. 3

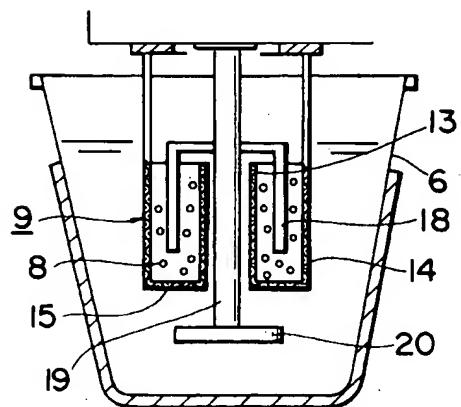
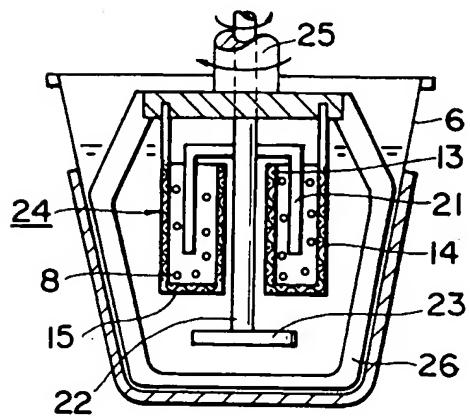


FIG. 4





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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 7294

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	FR-A-2 529 473 (SOC. NOUVELLE D'ÉTUDES ET DE PROCÉDÉS) * the whole document * ---	1,4	B02C17/16
A,D	DATABASE WPIL Section Ch, Week 8940, Derwent Publications Ltd., London, GB; Class J, AN 89-288459 & JP-A-1 210 020 (DAINIPPON TORYO K.K.) 23 August 1989 * abstract * ---	1,4	
A,D	DATABASE WPIL Section Ch, Week 8449, Derwent Publications Ltd., London, GB; Class J, AN 84-305134 & JP-B-59 046 665 (DAINIPPON TORYO K.K.) 14 November 1984 * abstract * ---	1,4	
A	US-A-3 329 348 (J.D. POOTMANS) * column 2, line 28 - line 33 * -----	6	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B02C
<p>The present search report has been drawn up for all claims</p>			
Place of search THE HAGUE	Date of completion of the search 09 NOVEMBER 1992	Examiner VERDONCK J.C.M.J.	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	